Staff Report

USE INFORMATION AND AIR MONITORING RECOMMENDATION FOR THE PESTICIDE ACTIVE INGREDIENT ETHOPROP

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A. BACKGROUND

This recommendation contains general information regarding the physical-chemical properties and the historical uses of the organophosphate pesticide *O*-Ethyl *S,S*-dipropyl phosphorodithioate (ethoprop). The Department of Pesticide Regulation (DPR) provides this information to assist the Air Resources Board (ARB) in their selection of appropriate locations for conducting pesticide air monitoring operations.

Ethoprop (CAS: 13194-48-4) exists as a clear, pale yellow liquid. Ethoprop has a molecular formula of $C_8H_{19}O_2PS_2$, and a molecular weight of 242.33 g/mole**.** It has a water solubility of 700 mg/L at 20 ºC, a Henry's Constant of 1.59×10^{-7} atm·m³/mol at 20–25 °C, and a vapor pressure of 3.49×10^{-4} mmHg (46.5 mPa) at 20 ºC. Ethoprop is miscible with acetone, *n*-hexane, and xylene.

The reported half-lives in humus-containing soil (pH 4.5) and a sandy loam (pH 7.2-7.3) were 87 and 14-28 days, respectively. Accelerated transformation of ethoprop after repeated soil applications was reported. When heated to decomposition, ethoprop emits toxic phosphorus and sulfer oxide fumes.

Ethoprop's acute oral LD_{50} is 262 mg/kg for rats. Its LC_{50} (96 hour) is 13.8 mg/L for rainbow trout, 2.1 mg/L for bluegill sunfish, and 13.6 mg/L for goldfish. Ethoprop entered the risk assessment process at DPR under SB 950 (Birth Defect Prevention Act of 1984) based on potential combined oncogenicity and chronic toxicity and mutagenic effects.

B. USE OF ETHOPROP

As of July 1, 1997, five ethoprop-containing products (Mocap®[†]) were registered for use in California. Ethoprop is a systemic, nonfumigant soil-applied nematicide-insecticide, used to control a variety of nematodes and insect pests. Ethoprop has a low volatility and can be applied before or after planting until immediately prior to crop emergence. DPR regulates ethoprop as a restricted use pesticide when it is used for the production of agricultural plant commodities. Restricted use pesticides may be possessed and used only by certified applicators who have obtained a special permit from their county agricultural commissioner.

With DPR's implementation of full pesticide use reporting in 1990, all users must report the agricultural use of any pesticide to their county agricultural commissioners, who

[†] Mocap® is the registered brand name for ethoprop-containing products. Mocap is a registered tradename of the Rhône-Poulenc Ag Company, P.O. Box 12014, 2 T.W. Alexander Drive, Research Triangle Park, NC 27709.

subsequently forward this information to DPR. DPR compiles and publishes the use information in the annual Pesticide Use Report (PUR). Because of California's broad definition for agricultural use, DPR includes data from pesticide applications to parks, golf courses, cemeteries, rangeland, pastures, and rights-of-way, postharvest applications of pesticides to agricultural commodities, and all pesticides used in poultry and fish production, and some livestock applications in the PUR. DPR does not collect use information for home and garden use, or for most industrial and institutional uses. The information included in this monitoring recommendation reflects cropland applications of ethoprop. Use rates were calculated by dividing the total pounds of ethoprop reported used (where ethoprop was applied to acreage) by the total number of acres reported treated.

According to the PUR, over 99 percent of California's total ethoprop use occurs in ten counties (Table 1). Historically, cropland applications account for over 97 percent of the total amount of ethoprop reported used each year. Non-agricultural applications—landscape maintenance—account for less than one percent of the total amount of ethoprop reported used each year.

In California, growers use ethoprop to control a variety of nematodes and wireworms in potatoes. Labeled use rates for ethoprop range from 3 to 12 pounds active ingredient (AI) per acre in potatoes. The higher rates of use are associated with moderate to severe infestations of nematodes or wireworms. Ethoprop is also used to control insects and nematodes in sweet potatoes and cabbage, but at much lower rates (1.5 to 6 pounds AI per acre). Ethoprop is formulated in either granular/flake form or as a ready-to-use liquid solution. Ethoprop-containing products include the Signal Word "Warning" or "Poison/Danger" on their labels, depending on the formulation or concentration of the product.

Table 1. Annual Agricultural Use of Ethoprop (Pounds of Active Ingredient)

COUNTY	1995	1994	1993
Siskiyou	26,014	20,158	22,177
San Joaquin	11,494	6,736	4,701
Modoc	9,116	11,270	14,380
Monterey	4,925	2,223	6,738
Santa Barbara	1,348	1,206	714
Amador	1,268	0	0
Riverside	1,321	313	494
San Luis Obispo	1,018	1,042	920
Kern	761	5,951	4,359
Merced	569	1,702	5,535
County Totals	57,834	50,601	60,018
Percent of Total	***>99%***	***99%***	***97%***
CALIFORNIA TOTAL	**57,936**	**51,270**	**62,143**

According to the PUR, Siskiyou County routinely receives the greatest applications of ethoprop; where growers apply nearly 40 percent of all the ethoprop used. Table 2 summarizes the total amounts and average daily rates of ethoprop reported applied in Siskiyou County during the months of greatest use. In Siskiyou County, reported applications of ethoprop are highest from mid-April through May and are associated with application to potatoes in the northeastern area of the County. Generally, growers use the granular formulation, applying before planting and immediately incorporating into the soil. The second highest reported use occurs in San Joaquin County in April; however, the amounts are half of those reported for Siskiyou County, and applications are scattered throughout the County.

Table 2. Ethoprop Applications in Siskiyou County

	1995		1994		1993	
MONTH	*Lbs Used*[1]	*Rate*[2]	*Lbs Used*[1]	*Rate*[2]	*Lbs Used*[1]	*Rate*[2]
May	18,265	12.3	7,459	7.4	16,389	9.1
April	7,749	10.8	12,602	10.2	4,094	10.3

[1] In pounds of active ingredient.

[2] Average rate (in pounds of active ingredient per acre).
The highest reported rates of ethoprop use average 12 lbs AI per acre (the highest labeled rate), and are associated with applications to potatoes.

C. RECOMMENDATIONS

1. Ambient Air Monitoring

The historical trends in ethoprop use suggest that monitoring should occur over a 30- to 45-day sampling period in the northeastern region of Siskiyou County from mid-April through May. Figure 1 shows applications routinely begin in mid-April, reach a peak during the last week in April and the first two weeks in May, then tail off throughout the remainder of the month. Figure 2 displays the areas of ethoprop use by section in northeastern Siskiyou County for 1994-1995. Figure 3 shows the same information for 1992-1993. Ethoprop is generally applied within two weeks before planting or before crop emergence. Severe weather conditions may affect the time of planting. Furthermore, this area is very close to Oregon potato growing regions. Care should be taken to prevent applications of ethoprop to nearby Oregon potato fields from contaminating collected samples. Because ethoprop is a restricted material, the county agricultural commissioner must issue a permit to each user before it is applied. These permits include information such as application site locations. For these reasons, DPR strongly recommends close coordination with the county agricultural commissioner to select the best sampling sites and periods.

Three to five sampling sites should be selected in relatively high-population areas or in areas frequented by people. Sampling sites should be located near potato growing areas. Ambient samples should not be collected from samplers immediately adjacent to fields or orchards where ethoprop is being applied. At each site, twenty to thirty discrete 24-hour samples should be taken during the sampling period. Background samples should be collected in an area distant to ethoprop applications.

Replicate (collocated) samples are needed for five dates at each sampling location. Two collocated samplers (in addition to the primary sampler) should be run on those days. The date chosen for replicate samples should be distributed over the entire sampling period. They may, but need not be, the same dates at every site. Trip blank and field spike samples should be collected at the same environmental conditions (e.g., temperature, humidity, exposure to sunlight) and experimental conditions (e.g., air flow rates) as those occurring at the time of ambient sampling.

2. Application-Site Air Monitoring

The historical trends in ethoprop use suggest that application-site air monitoring should also be conducted from mid-April through May in northeastern Siskiyou County in association with application to potatoes. Monitoring should occur at a site of highest rate of use—12 pounds AI per acre. Because the degree of nematode infestation—and thus, the rate of ethoprop use—may vary from location to location, DPR recommends close coordination with the county agricultural commissioner to select the best sampling sites. Ethoprop is intensively applied during this period so care should be taken to prevent nearby applications from contaminating collected samples. Again, care should be taken to prevent applications of ethoprop to nearby Oregon potato fields from contaminating collected samples.

A three day monitoring period should be established with sampling times as follows: application + 1 hour, followed by one 2-hour sample, one 4-hour sample, two 8-hour samples and two 24-hour samples. A minimum of four samplers should be positioned, one on each side of the field. A fifth sampler should be collocated at one position. Since ethoprop is extensively used in the area, background samples should collect enough volume (either 12 hours at 15 liters/min, or a shorter period with a higher volume pump) to permit a reasonable minimum detection level. Ideally, samplers should be placed a minimum of 20 meters from the field. Trip blank and field spike samples should be collected at the same environmental conditions (temperature humidity, exposure to sunlight) and experimental conditions (similar air flow rates) as those occurring at the time of sampling.

Additionally, we request that you provide in the monitoring report: 1) an accurate record of the positions of the monitoring equipment with respect to the field, including the exact distance that the sampler is positioned from the field; 2) an accurate drawing of the monitoring site showing the precise location of the meteorological equipment, trees, buildings, and other obstacles; 3) meteorological data collected at a minimum of 15-minute intervals including wind speed and direction, humidity, and air temperature, and comments regarding degree of cloud cover; and 4) the elevation of each sampling station with respect to the field, and the orientation of the field with respect to North (identified as either true or magnetic North).

D. SAFETY RECOMMENDATIONS

A cholinesterase inhibitor, ethoprop is rapidly absorbed through the skin, and became a restricted use pesticide because of its acute dermal toxicity. The symptoms of poisoning may include nausea, vomiting, abdominal cramps, diarrhea, excessive salivation, headache, dissiness, weakness, blurring or dimness of vision, excessive tearing, loss of muscular coordination, slurring of speech, twitching of muscles (especially of the tongue and eyelids), mental confusion, disorientation, drowsiness, tightness in the chest, and runny nose.

Therefore, monitoring personnel should use proper protective equipment if there is a possibility of exposure to breathing the fumes, or spray mist (if liquid formulation used). According to the label, proper equipment for applicators includes Tyvek® coveralls over long-sleeved shirt and long pants, chemical resistant gloves (such as disposable nitrile rubber), chemical resistant footwear plus socks, protective eyewear, and a cartridge respirator equiped with a filter cartridge approved for use with organophosphate pesticides. The restricted entry interval following ethoprop application is 48 hours. The interval is increased to 72 hours in outdoor areas where average rainfall is less than 25 inches per year. Monitoring personnel should read and refer to the label of the actual product used for further precautions.

E. REFERENCES

Kelley, K. and N.R. Reed. 1996. Pesticides for evaluation as candidate toxic air contaminants. Department of Pesticides Regulation. Sacramento, California. Report No. EH 96-01.

Montgomery, J.H. 1993. Agrochemicals Desk Reference: Environmental Data. Lewis Publishers, Chelsea, Michigan.